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10/773,185	02/09/2004	Kia Silverbrook	MTB27US	8427

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EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

DATE MAILED: 02/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,185	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-16,18-21,23-35,37-52 and 54* is/are rejected.

7)☒ Claim(s) *4,17,22,36 and 53* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/16/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 2 recites the limitation "the axis" in line 1 and "the aperture" in line 1. There is insufficient antecedent basis for these limitations in the claim.

Claim 4 recites the limitation "the serpentine form" in line 1. There is insufficient antecedent basis for this limitation in the claim.

In claims 18 and 37, line 1 of each claim recites, "each heater element is *substantially* covered . . . such that the coating is seamless." This statement is unclear since a substantially covered element would not be seamless.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 3, 5, 6, 8, 10, 11, 13, 14, 19, 20, 21, 23, 24, 25, 27, 29, 30, 32, 33, 38, 40, 41, 42, 43, 44, 46, 47, 49, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2).

Silverbrook teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 5, lines 34-38*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*elements 41, Figure 3*);

a bubble forming chamber corresponding to each of the nozzles (*element 112, Figure 9*);

at least one heater element disposed in each of the bubble forming chambers respectively (*element 120, Figure 12*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*); such that,

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); wherein,

the heater element is a suspended elongated strip (*element 441, Figure 13*)

***further regarding claim 38**, supplying the nozzle with a replacement volume of the liquid equivalent to the ejected drop (*col. 12, lines 59-61*);

***regarding claims 2 and 20**, the axis extends through the center of the aperture (*imaginary Z-axis through nozzle 445, Figure 13*)

***regarding claims 3 and 21**, the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*) and the heater element extends between two adjacent electrodes spaced from each other by a gap (*unreferenced gap between electrodes on left side of chamber, Figure 58b*), wherein the heater element has a second gap diametrically opposed to the gap between electrodes (*unreferenced gap between electrodes on right side of chamber, Figure 58b*)

***regarding claims 5, 24, and 42**, the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 9, lines 26-30*)

***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and to be a page-width printhead (*col. 2, lines 19-22*)

***regarding claims 8, 27, and 44**, each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29, and 46**, a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm:* $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$)

***regarding claims 11, 30, and 47**, each heater element has two opposite sides (*sections of heater element 120 on the left and right sides of the chamber 488, Figure 18*) and is configured such that a gas bubble formed by that heater element is formed at both of the sides of that heater element (*bubble 116 formed on both sides, Figure 18*)

***regarding claims 13, 32, and 50**, a structure that is formed by chemical vapor deposition, the nozzles being incorporated on the structure (*col. 5, lines 47-49*)

***regarding claims 14, 33, and 49**, a structure that is less than 10 microns thick, the nozzles being incorporated on the structure (*col. 9, lines 8-10*)

***regarding claim 23**, support the bubble forming liquid in thermal contact with each heater element (*col. 17, lines 37-43*), and to support the ejectable liquid adjacent each nozzle (*col. 17, lines 37-40*)

***regarding claim 40**, the heater element extends between the electrodes mounted on opposite sides of the bubble forming chamber (*heater element 121 extending between unreferenced electrodes on opposite sides of chamber, Figure 58b*)

Silverbrook does not expressly teach:

***regarding claims 1, 19, and 38**, the heater element is suspended, the strip having a cross section with a lateral dimension at least triple that of the thickness of the strip

***regarding claim 41**, the heater element is less than 0.3 microns thick and more than 1 micron wide

Gerber et al. teaches the following:

***regarding claims 1, 19, and 38**, the heater element is suspended (*col. 4, lines 31-32*)

Hiramatsu et al. teaches the following:

***regarding claims 1, 19, and 38**, the heater element has a cross section with a lateral dimension at least triple that of the thickness of the strip (*aspect ratio of 10-5000, lines 46-48*)

***regarding claim 41**, the heater element is less than 0.3 microns thick and more than 1 micron wide (*the width may be 0.1 mm, col. 15, lines 33-35; using the disclosed aspect ratio of 5000 from col. 15, lines 46-48, the thickness would be 0.02 microns*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's heater resistor to be suspended. The motivation for doing so, as taught by Gerber et al., is so that the resistor will quickly increase in temperature since the heat is not absorbed by the substrate (*col. 4, lines 32-38*).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to further modify Silverbrook's heater resistor to have a cross section with a lateral dimension at least triple that of the thickness of the resistor strip. The motivation for doing so,

as taught by Hiramatsu et al., is to increase the resistance value of the heating elements and keep the evenness of the temperature on the heating face (*col. 15, lines 49-52*).

Claims 7 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2), as applied to claim 1 above, and further in view of Lebens et al. (US 6631979 B2).

Silverbrook, Gerber et al., and Hiramatsu et al. teach all claimed limitations except for the following:

***regarding claims 7 and 26**, the heater element is in the form of a cantilever beam

Lebens et al. teaches the following:

***regarding claims 7 and 26**, the heater element is in the form of a cantilever beam (*col. 3, lines 8-17*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook, Gerber et al., and Hiramatsu et al.'s heater element to be cantilevered. The motivation for doing so, as taught by Lebens, is so that the heater element can be operated at reduced energy (*col. 2, lines 57-61*)

Claims 9, 28, and 45 are rejected as best understood under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2), as applied to claim 1 above, and further in view of Otsuka et al. (US 5485179).

Silverbrook, Gerber et al., and Hiramatsu et al. teach all the claimed limitations except for the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point

Otsuka et al. teaches the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to heat the heater element to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (*col. 13, lines 21-28 shows that the energy required to heat the heater is less when the ambient temperature is high, and more when the ambient temperature is low; therefore, Otsuka teaches that it would take less energy to eject a drop of ink than it would to heat ink from an ambient temperature to a boiling temperature*).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's invention with Otsuka's heating configuration. The motivation for doing so, as taught by Otsuka, is to control the temperature of the recording head based on the present ambient temperature (*col. 12, lines 41-49*).

Claims 12, 31, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2), as applied to claim 1 above, and further in view of Campbell et al. (US 4870433).

Silverbrook, Gerber et al, and Hiramatsu et al. expressly teach all claim limitations except the following:

***regarding claims 12, 31, and 48,** the bubble, which each element is configured to form, is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element

Campbell et al. teaches the following:

***regarding claims 12, 31, and 48,** the bubble that each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (*col. 3, lines 60-64*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to use the heater element design of Campbell to modify the invention of Silverbrook, Gerber et al., and Hiramatsu et al. The motivation for doing so, as taught by Campbell et al., is to prevent cavitational damage to the heater elements (*col. 3, lines 14-23*).

Claims 15, 16, 18, 34, 35, 37, 51, 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2), as applied to claim 1 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Silverbrook teaches the following:

***regarding claims 15, 34, and 51,** a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 7, lines 42-44*), and a plurality of heater elements being disposed within each chamber (*col. 9, lines 20-23 with heaters 120, Figure 12*).

Silverbrook, Gerber et al., and Hiramatsu do not expressly teach:

***regarding claims 15, 34, and 51**, the heater elements within each chamber are formed on different respective layers to one another

***regarding claims 16, 35, and 52**, each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50

***regarding claims 18, 37, and 54**, each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless

Anagnostopoulos et al. teaches the following:

***regarding claims 15, 34, and 51**, the heater elements within each chamber are formed on different respective layers to one another (*col. 8, lines 36-38*)

***regarding claims 16, 35, and 52**, each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54**, each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Gerber et al. (US 6680668 B2), and further in view of Hiramatsu et al. (US 6967312 B2), as applied to claim 38 above, and further in view of Moon et al. (US 6761433 B2).

Silverbrook teaches the following:

***regarding claim 39,** the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*) and the heater element extends between two adjacent electrodes spaced from each other by a gap (*unreferenced gap between electrodes 442, Figure 13*)

Silverbrook, Gerber et al., and Hiramatsu et al. do not teach the following:

***regarding claim 39,** the heater element is omega shaped

Moon et al. teaches the following:

***regarding claim 39,** the heater element is omega shaped (*resistors 104, Figure 5A*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Silverbrook's heater element to be omega shaped. The motivation for doing so, as taught by Moon et al., is to provide another embodiment of a resistor that is spaced from the central axis of the nozzle (*col. 6, lines 4-8*).

Allowable Subject Matter

Claims 4, 17, 22, 36, and 53 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The primary reason for the indication of allowable subject matter in claim 4 is the inclusion of the limitation of an inkjet printhead wherein the heater element strip is a double omega shape wherein a first omega shape extends between two adjacent electrodes spaced from each other by a gap, and a second omega shape is inverted relative to the first and extending between a second gap in the first omega shape, the second gap in the first omega being positioned diametrically opposite the gap between the electrodes. It is this limitation found in

the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for the indication of allowable subject matter of claim 17 is the inclusion of the limitation of an inkjet printhead wherein each heater element is formed of solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop. It is this limitation found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for the indication of allowable subject matter of claim 22 is the inclusion of the limitation of a printer system wherein the heater element strip is a double omega shape wherein a first omega shape extends between two adjacent electrodes spaced from each other by a gap, and a second omega shape is inverted relative to the first and extending between a second gap in the first omega shape, the second gap in the first omega being positioned diametrically opposite the gap between the electrodes. It is this limitation found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for the indication of allowable subject matter in claim 36 is the inclusion of the limitation of a printer system wherein each heater element is formed of solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a

drop. It is this limitation found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which indicates allowable subject matter.

The primary reason for the indication of allowable subject matter in claim 53 is the inclusion of a method of ejecting drops including the method step of heating a mass of less than 10 nanograms of the solid material of each such heater element to a temperature above the boiling point. It is this step found in the claims, as it is claimed in the combination, that has not been found, taught, or suggested by the prior art of record which makes these claims allowable over the prior art.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Breimesser (DE 4025619 A1) discloses a cantilevered heater resistor. Abe et al. (US 4914562) discloses various embodiments of heater resistors.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SLF

R. FEGGINS
PRIMARY EXAMINER
2/04